LIFESTYLE ASSOCIATED RISK FACTORS FOR NON-COMMUNICABLE DISEASES IN ADOLESCENTS

DISSERTATION SUBMITTED FOR
BRANCH VII
MEDICINE (PAEDIATRIC MEDICINE)
- M.D. DEGREE EXAMINATIONS

TO

The Tamil Nadu Dr. M.G.R. Medical University, Chennai.

April 2011

CERTIFICATE

CERTIFICATE

This is to certify that, this dissertation titled **LIFESTYLE ASSOCIATED RISK FACTORS FOR NON-COMMUNICABLE DISEASES IN ADOLESCENTS** is a bonafide work done under our supervision by **Dr.M.Radhamani**, at Coimbatore Medical College Hospital, for MD Paediatrics Degree examination – April- 2011.

Dr. R. Vimala MD.,
The Dean,
Coimbatore Medical College,
Coimbatore.

Dr. K.Neelakandan M.D.DCH.,
Professor &HOD,
Department of Paediatrics,
Coimbatore Medical College,
Coimbatore.

DECLARATION

DECLARATION

I, Dr.M.RADHAMANI hereby solemnly declare that the dissertation titled **"LIFESTYLE ASSOCIATED RISK FACTORS FOR NON-COMMUNICABLE DISEASES IN ADOLESCENTS"** was done by me in Coimbatore Medical College and Hospital from September 2009 to September 2010 under the supervision and guidance of **Prof.Dr.K.NEELAKANDAN M.D.DCH.,** This dissertation is submitted to Tamil Nadu DR.M.G.R. Medical University, towards partial fulfillment of requirement for the award of M.D. Degree in Paediatric Medicine.

Place : Coimbatore **Dr. M. RADHAMANI**

Date :

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

I sincerely thank **Dr.VIMALA M.D.,** DEAN Coimbatore Medical College Hospital Coimbatore, Our Medical Superintendent **Dr. Mathivanan M.S.DCH.,** for allowing me to do this dissertation and to utilize the facilities of this institution.

I am most indebted to my teacher and Head of the Department **Prof.Dr.Neelakandan M.D.DCH.,** for the boundless affection and kind encouragement given by him throughout the study.

I remember with gratitude our beloved chief, **Prof. Dr. Vanitha M.D.DCH.,** for her immense guidance and encouragement during this study.

I shall thank**, Registrar Dr.Theenathayalan M.D.DCH.,** for his guidance and advise.

I express my sincere thanks to **Assistant Prof. Dr.Booma M.D (Paediatrics).,** for her guidance, meticulous supervision and encouragement throughout the study.

I shall always regard with gratitude my assistant professors, **Dr.Kumar M.D (Paediatrics)., Dr.Uma Shankar M.D.DCH., Dr.Jaya Prakash MD (Paediatrics)., Dr.Senthil Kumar M.D.DCH., Dr. Suganthi M.D.DCH.,** and **Dr.Rukmani M.D(Paediatrics).,** for their able guidance and assistance in doing this work.

I thank all the children and their parents for their consent and cooperation with out which this study would not have been possible.

CONTENTS

CONTENTS

INTRODUCTION

INTRODUCTION

NON COMMUNICABLE DISEASES

Increasing trends of non-communicable diseases is a worldwide phenomenon. Globally deaths from non-communicable diseases is expected to climb to 49.7 million in 2020, an increase of 77% in absolute numbers and increase in their share of the total from 55% in 1990 to 73% in 2020[8].

Non communicable diseases are obesity, hypertension, myocardial infarction, angina pectoris, stroke, type 2 diabetes mellitus. Among these obesity is the most common non communicable disease in adolescents. Obesity in childhood is an important risk factor for obesity in adulthood and up to 80% of them become obese adults. The National Health and Nutrition Examination Survey (NHANES)IV, 1999-2002 documents that 16% of children are overweight and 31% are at risk for becoming overweight representing a nearly 300% increase since the 1960s and a 45% increase since the last complete NHANES survey for 1988-94[1].

OBESITY

Overweight results from dysregulation of caloric intake and energy expenditure. It is attributable to urbanization, high fat, high sugar

containing junk food, technology based sedentary life style, increasing purchasing power, lack of exercise, excessive TV/computer viewing etc.

BIOCHEMICAL CHANGES IN OBESITY:

COMPONENTS OF ENERGY BALANCE:

Energy intake: Calorie or energy content of food varies from 4 kcal /g for carbohydrates to 9 kcal /g for fat.

Energy expenditure: Resting metabolic rate + meal induced thermogenesis +physical activity energy expenditure.

Energy storage: When energy exceeds energy expenditure ,a state of positive energy balance occurs. When overfeeding relative to energy needs occurs ,the body increases its overall energy stores.

Each of these factors are determined by various factors.

RESTING METABOLIC RATE:

It is the energy expended by the body to maintain physiologic functions like heart beat ,muscle contractions and respiration.It is the minimum level of energy expended by the body to sustain life.

Meal induced thermogenesis occurs over an extended period of atleast 5 hours. Cumulative energy cost is equivalent to approximately

10% of energy utilized. The thermogenic effect is higher for proteins (30%) and carbohydrates(15%) than for fat.

The physical activity energy expenditure is determined by the amount or duration of activity, type of activity and the intensity with which the activity is performed.

FOOD HABITS

The food industry supports sophisticated advertising that encourages people to eat convenience foods, which are relatively inexpensive and have high levels of calories, fat, simple carbohydrates and sodium and low levels of fiber and micronutrients. Snacking in between meals has risen steadily over the last two decades with many snacks being high in fat, sugar or both.

The convenience of fast food, the increase in dual working parents and single parent households, and the common practice of over scheduling children have led to fast food being a staple diet of many families. A typical single meal can contain 2000kcal, 84g fat and only 12g of fiber. Sweetened beverages have been linked to higher weight, increased risk of obesity increased caloric intake because children who drink high amounts of sugar do not eat significantly less at meals.

PHYSICAL ACTIVITY

Increase in sedentary activity and lack of exercise also contribute to increase in the prevalence of overweight. Budget constraints have led many school systems to reduce or eliminate physical education classes. Children may watch as much as 20hr/wk of television, which decreases their physical activity, exposes them to food advertising and increases caloric intake. Other 'screen time' such as video games, Internet computer use, telephone use and home viewing of movies all may reduce childhood physical activity.

BODY MASS INDEX

The diagnosis of obesity is based on calculation of the Body Mass Index by dividing the weight in kilograms by the height in meters squared (kg/m2). The calculated BMI can overestimate adiposity in trained athletes or muscular children but it is generally recognized as the most reliable method to determine healthy and unhealthy adiposity. Other methods of determining adiposity are useful but are either too expensive to be of practical use in a clinical setting (ultrasound, CT, MRI, Dual Energy X ray Absorbometry, total body conductivity, air displacement plethysmography), or require specialized training (skin fold thickness),or have poor reproducibility (waist hip ratios). Therefore, BMI in combination with clinical assessment is sufficient to make the

diagnosis. Absolute numbers for BMI in adults determine adiposity. Given changing adiposity during childhood, the BMI percentile is used for classification.

BMI percentile for age –	weight status
<5th percentile	- underweight
5th -84th percentile	- normal weight
85th -94th percentile	- at risk for overweight
>94th percentile	- overweight

Consistent use of the BMI growth chart aids in early identification of children at risk for later obesity[1].

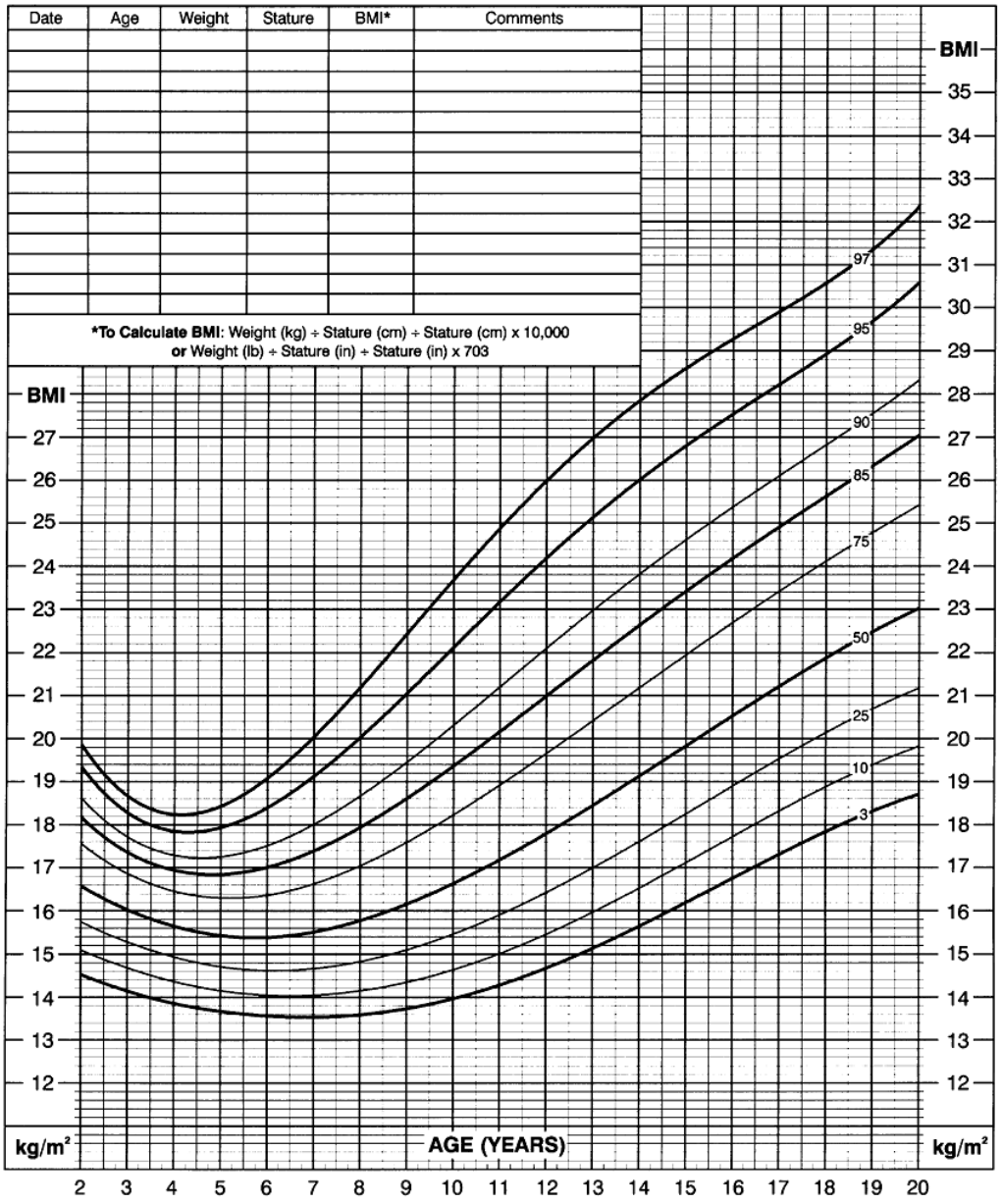
Graph – 1

Body Mass Index for Age Percentiles –Boys

2 to 20 years: Boys
Body mass index-for-age percentiles

NAME _____

RECORD # _____



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

CDC
SAFER · HEALTHIER · PEOPLE™

Graph – 2

Body Mass Index for Age Percentiles –Girls

2 to 20 years: Girls
Body mass index-for-age percentiles

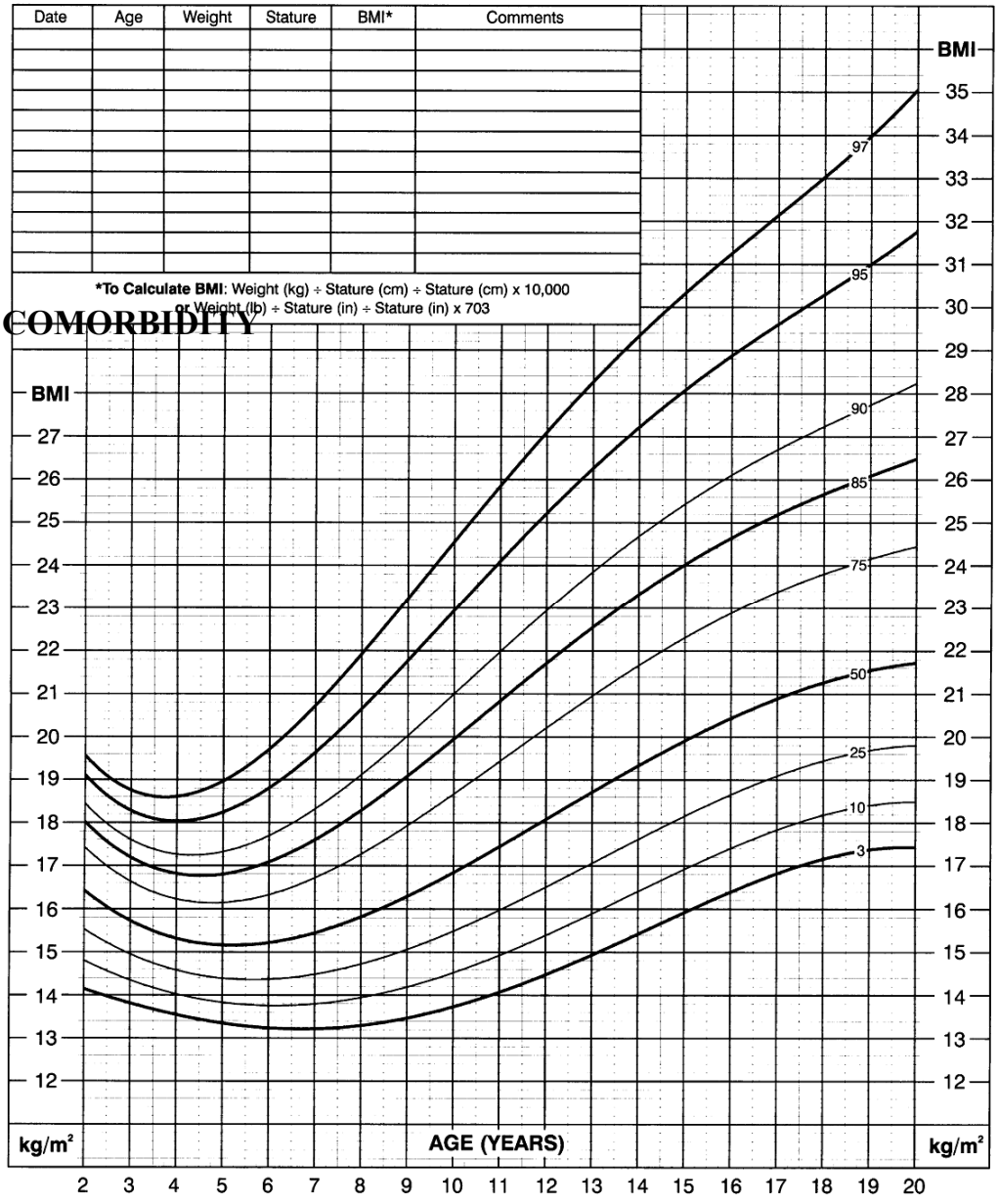
NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703

COMORBIDITY



Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

CDC
SAFER · HEALTHIER · PEOPLE™

People with a BMI of 25 or above have an increased risk of developing comorbidities , which is further increased with BMI values of 30 or more. Virtually all obese people will have developed physical symptoms by 40years of age, and the majority will require medical intervention for diseases that develop as a direct result of their obesity by the age of 60 years. For BMI values of 40 or more (severe or morbid obesity), the risk of a life-threatening disease developing as a direct result of obesity is extremely high.

Obesity not only causes much psychological morbidity , but is also a primary risk factor in the development of hypertension, cardiovascular disease, stroke, diabetes mellitus, hyperlipidemia, osteoarthritis, and cancer of the breast, ovary, prostate and colon.

Obesity is associated with a considerably increased risk of endometrial cancer(the relative risk of 5.4 for those weighing 40% or more than average), and a greater risk of breast cancer in premenopausal women, and to some extent of bowel cancer in men.

The proportion of common diseases that can be attributed to excess body weight is shown in table A. Hip fracture is expressed as a negative proportion ,as people who are excessively overweight or obese are less likely to experience a hip fracture than those who are underweight.

Table A- Proportion of various diseases attributable to excess weight (BMI>27 kg/m^2)

DISEASE	PROPORTION(%)
Obesity	100.0
Hypertension	24.1
Myocardial infarction	13.9
Angina pectoris	20.5
Stroke	25.8
Venous thrombosis	7.7
Type 2 diabetes mellitus	24.1
Hyperlipidemia	7.7
Gout	20.0
Osteoarthritis	11.8
Gall bladder disease	14.8
Colorectal cancer	47
Breast cancer	3.2
Genitourinary cancer	9.1
Hip fracture	3.5

Obesity leads to premature mortality. A man weighing more than 140% of the average weight is 5.2 times more likely to die of diabetes than a man of ideal weight. Similarly, women who are more than 140% overweight 7.9 times more likely to die of diabetes than women of ideal weight. After adjustment for age and smoking, the risk of a fatal or non fatal myocardial infarction among women with a BMI greater than 29 is three times that among lean women.

Osteoarthritis is a common complication of obesity, especially in weight bearing joints such as knee and hips. The risk of osteoarthritis is related to the total amount of fat, rather than to the extent of abdominal fat.

People who are obese are more likely to develop gall stones because of their high output of cholesterol in bile.

Obesity is also associated with reproductive and menstrual disorders. Sleep apnoea is caused by the physical pressure effects of fat on the chest wall and upward pushing on the liver, which compresses the lungs and leads to poor lung ventilation. In addition fat around the neck of an obese person may compress the trachea.

A newly identified hormone, resistin, links obesity to type 2 diabetes and partly explains how obesity predisposes people to diabetes. Resistin is thought to be secreted by fat cells and then to modify the body' s sensitivity to insulin, causing insulin resistance[22].

TREATMENT

Successful treatment of obesity is challenging, and treatment goals vary, depending on the age of the child and the severity of complications from being overweight. Children are still growing, so severe caloric restriction and weight loss may be detrimental. Weight maintenance

rather than weight loss is frequently a reasonable initial goal. As children grow in stature, BMI decreases. Weight loss should be attempted only in skeletally mature children or in those with serious complications from obesity. Weight loss should be slow(1 lb or 0.5 kr or less per week), because more rapid weight loss requires overtly restrictive dieting. An initial goal of a 10% reduction in weight is reasonable because this amount of weight loss has been shown to significantly improve overall health. Once achieved ,the new weight should be maintained for 6 months before further weight loss is attempted.

MULTIDISCIPLINARY AND COMMUNITY BASED MANAGEMENT:

Community based programs to inform families regarding age appropriate healthy eating choices, meal and portion size planning, decreasing "screen time", and approaches to increasing physical activity provide an important service for families with children at risk for becoming overweight or mildly to moderately overweight without comorbidities.

DIETARY COUNSELLING:

Recommendations for healthy eating should be age specific and flexible enough to accommodate family and ethnic food preferences . In toddlers, limiting sweetened beverages is usually the most useful initial

strategy. Other simple interventions include changing to skim milk in children older than the age of 2 years and assuring exposure to less calorie dense food choices and limitation of between- meal snacking. For pre school- aged children, sweetened beverages should be limited and parents should continue to offer healthy foods. The parents should be educated about approaches to dealing with food refusals as diets are modified. It often requires more than 10 repeated exposures to a new food before a child will regularly accept it as a part of regular diet.

As children reach school age, busy schedules and exposure to food advertisements often increase fast food intake. Education regarding meal planning and the value of family mealtimes in maintaining family structures can decrease the number of meals eaten away from home. Including children in meal choices and food preparation help them to learn healthy eating patterns .Adolescents also fall victim to busy schedules and their increasing independence, they are more likely to develop unhealthy eating patterns, such as skipping meals and following fad diets. Encouraging children to eat breakfast, decreasing their intake of sweetened beverages, and teaching them the principles of balanced nutrition(eating from all food groups) are useful strategies for the overweight adolescent.

PHYSICAL ACTIVITY:

Decreasing sedentary activity is essential for achieving weight control. Increasing activity not only increases calorie use but also appears to decrease appetite .In children younger than 2 years, the AAP recommends avoiding television and computers. Children 2 to 18 years of age should have < 2 hours of"screen time"(television , video games, computer) and television should be removed from children s bedroom .Enforcing this behavioral change is difficult unless the entire family decreases sedentary activity and screen time. Children use computers for homework and this must be taken into account when giving recommendations .Although prescribed exercise regimens can be useful, an office setting gives little opportunity to provide such guidance. Simple measures, such as daily walks ,can be discussed . In the severely overweight child, problems of exercise tolerance may warrant referral to an experienced physical or exercise therapist to provide a safe and graded exercise regimen. Identifying opportunities in the community for increased physical activity can be of great importance to some families.[1]

BEHAVIOURAL MODIFICATION

Any behavioural approach should take into account the fact that eating is a highly reinforcing behavior. The five stages of change include the following:

1.Pre-contemplation: “the stage at which there is no intention to change behaviour in the foreseeable future”.

2.Contemplation: “ the stage at which people are aware that a problem exists and are seriously thinking about overcoming it, but have not yet made a comminent to take action”.

3.Preparation: “the stage that combines intention and behavioural criteria, individuals at this stage are intenting to take action in the next month, and may have unsuccessfully taken action in the past year”.

4.Active change: “the stage at which individuals modify their behavior, experience or environment in order to overcome their problems”.

5.Maintenance: “the stage at which people work to prevent relapse and consolidate the gains attained during the action”.[22]

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Goyal RK et al[2]: Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated lifestyle factors.

1. The study was carried out in 5664 school children of 12-18 years of age and having different SES. The obesity and overweight were considered using an updated body mass index reference. SES and life style factors were determined using pre-tested questionnaire.

2. Age-adjusted prevalence of overweight was found to be 14.3% among boys and 9.2% among girls where as the prevalence of obesity was 2.9% in boys and 1.5% in girls. Eating habit like junk food, chocolate, eating outside at weekend and physical activity like exercise, sports, sleeping habit in afternoon having remarkable effect on prevalence on overweight and obesity among middle to high SES group. Family history of diabetes and obesity were also found to be positively associated.

Singhal N et al[3]: Secular trends in obesity, regional adiposity and metabolic parameters among Asian Indian adolescents in north India: a comparative data analysis of two selective samples 5 years apart (2003, 2008).

1 . To assess and compare the secular trends in anthropometric and biochemical parameters over 5 years (2003-2008) amongst Asian Indian adolescents in north India.

2. Over the last 5 years, there has been a significant increase in abdominal obesity and FBG and a decrease in HDL-c amongst Asian Indian adolescents from north India, which puts them at risk for metabolic disorders at an early age. In view of these data, primary prevention strategies for childhood obesity need to be strengthened.

Eur J Clin Singhal N, Misra A, Shah P, Gulati S[4]: Effects of controlled school-based multi-component model of nutrition and lifestyle interventions on behavior modification, anthropometry and metabolic risk profile of urban Asian Indian adolescents in North India.

1. To study the effectiveness of a multi-component intervention model of nutrition and lifestyle education on behavior modification, anthropometry and metabolic risk profile of urban Asian-Indian adolescents in North India.
2. Two schools matched for student strength and middle socioeconomic strata were randomly allocated to intervention and control group. Changes in nutrition-related knowledge, attitude, lifestyle practices, food frequency and body image of eleventh-grade students (15-17 years) in both schools were tested using a validated questionnaire. Anthropometric

and biochemical measurements were made using standard methods. Segmental body composition analysis was carried out using an 8-electrode multi frequency bioelectrical impedance method of body fat estimation.

3. Multi-component model of nutrition and lifestyle education was successful in improving the nutrition-related knowledge, eating habits and lifestyle practices, and resulted in beneficial changes in anthropometric and biochemical profiles of the Asian Indian adolescents. This model should be applied on countrywide basis to prevent obesity and diabetes.

Vikram NK, Pandey RM, Misra A, Goel K, Gupta N[5]: Factor analysis of the metabolic syndrome components in urban Asian Indian adolescents.

1. This cross-sectional study included 948 subjects (527 males; 421 females) aged 14-19 y, selected randomly from New Delhi, India.
2. . Principal component factor analysis included variables such as: body mass index (BMI), waist circumference (WC), triceps (TR) and subscapular (SS) skinfold thickness, systolic and diastolic blood pressures, fasting blood glucose, serum triglycerides, high-density lipoprotein cholesterol and fasting insulin.

3. Overweight and hyperinsulinemia in both genders and high SS in males were independently associated with high cumulative risk. More than one factor is associated with the metabolic syndrome in Asian Indian adolescents. Obesity (generalized, abdominal and truncal sub-cutaneous) accounts for the maximum variance in clustering and appears to be the stronger correlate of high cumulative risk rather than hyperinsulinemia.

Gupta R, Misra A, Vikram NK, Kondal D, Gupta SS, Agrawal A, Pandey RM[6]: Younger age of escalation of cardiovascular risk factors in Asian Indian subjects.

1. Population based epidemiological studies to identify cardiovascular risk factors were performed in North India in 1999-2002.
2. They evaluated major risk factors-smoking or tobacco use, obesity, truncal obesity, hypertension, dysglycemia and dyslipidemia using pre-specified definitions in 2051 subjects (male 1009, female 1042) aged 15-39 years of age
3. Low prevalence of multiple cardiovascular risk factors (smoking, hypertension, dyslipidemias, diabetes and metabolic syndrome) in adolescents and rapid escalation of these risk factors by age of 30-39 years is noted in urban Asian Indians. Interventions should focus on these individuals.

Chathurvedi D, Khadgawat R, Kulshrestha B, Gupta N, Joseph AA, Diwedi S, Ammini AC[7]: Type 2 diabetes increases risk for obesity among subsequent generations.

1. Children and adolescents attending our pediatric and adolescent endocrine clinic with the main complaint of overweight or obesity were included in this study.
2. All subjects underwent detailed history, physical examination, hemogram liver function tests, oral glucose tolerance test, plasma insulin, and body fat estimation.
3. Children from families with diabetes mellitus are at risk for obesity. Hyperinsulinemia, by its action on the brain, induces behaviors and lifestyles conducive to obesity.

Singh AK, Maheshwari A, Sharma N, Anand K[8]: Lifestyle associated risk factors in adolescents. Indian J Pediatr.

1. This study was conducted to evaluate the prevalence of lifestyle associated risk factors for non-communicable diseases in apparently healthy school children in an urban school in Delhi using standard criteria.
2. The study was carried out among 510 students of classes 9th-12th of a school in New Delhi and in the age group of 12 to 18 years. The students

were surveyed through an age appropriate modified GSHS (Global School Based Student Health Survey) self administered questionnaire.

3. The study documents the inappropriate dietary practices (fast food consumption, low fruit consumption), low physical activity, higher level of experimentation with alcohol and to a lesser extent smoking, high prevalence of obesity and hypertension in the school children. The study also showed an association between BMI, systolic and diastolic blood pressures amongst children and other lifestyle factors.

Anand K, Shah B, Yadav K, Singh R, Mathur P, Paul E, Kapoor SK[9]: Are the urban poor vulnerable to non-communicable diseases? A survey of risk factors for non-communicable diseases in urban slums of Faridabad. Natl Med J India.

1. This survey was done from February 2003 to June 2004 and included 1260 men and 1 304 women 15-64 years of age living in urban slum areas of Ballabgarh block, Faridabad district, Haryana.
2. The high prevalence of risk factors for noncommunicable diseases across all age groups in this urban slum community indicates the likelihood of a high future burden of illness. Immediate action for prevention and control is required to prevent the situation from worsening.

Sugathan TN, Soman CR, Sankaranarayanan K[10]: Behavioural risk factors for non communicable diseases among adults in Kerala, India.

1. A cross-sectional study was done in which the data were collected from a sample of 6579 individuals of age 30 to 74 yr, randomly selected following a stratified multi-stage cluster sampling design covering Kerala State.
2. The important factors investigated include various behavioural risk factors, presenting chronic diseases and family histories among close relatives. The two major risk factors observed among males were smoking and alcohol consumption.
3. Substantially high levels of the various behavioural risk factors among adults in Kerala suggests an urgent need for adopting healthy life style modifications among the population in general. The increased risk observed among the younger generation for behavioural risk factors such as smoking and alcohol consumption calls for urgent corrective steps and measures for long-term monitoring of all major risk factors as well as the major chronic disease conditions.

Nath A, Garg S, Deb S, Ray A, Kaur R[11]: Profile of behavioural risk factors of non-communicable diseases in an urban setting in New Delhi. Indian J Public Health.

1. This study was conducted to assess the prevalence of behavioural risk factors of non communicable diseases among urban adult population.
2. There is a need to develop strong community based lifestyle behavioural intervention programs.

STUDY JUSTIFICATION

There is a paradox of under nutrition and obesity coexisting in developing countries like India. It is attributable to urbanization, high fat, high sugar junk food, technology based sedentary lifestyle, increasing purchasing power, lack of exercise, excessive TV viewing etc.

Non communicable diseases like obesity, diabetes mellitus, hypertension, coronary artery disease in adults is related to prevalence of risk factors in childhood. Hence, there is a definite need to monitor the prevalence of these risk factors in this age group and plan intervention measures for the same.

The data on these risk factors in school age is deficient in India. The present study was conducted to evaluate the prevalence of lifestyle associated risk factors for non-communicable diseases in apparently healthy schoolchildren in urban schools in Coimbatore using standard criteria.

AIM OF THE STUDY

AIMS AND OBJECTIVES

To evaluate the prevalence of lifestyle associated risk factors for non-communicable diseases in apparently healthy adolescents in urban schools in Coimbatore.

METHODOLOGY

METHODOLOGY

- STUDY DESIGN : Cross Sectional Study.
- PLACE OF STUDY : Urban Schools in Coimbatore City (Private schools – upper socioeconomic group).
- STUDY PERIOD : March 2009-October 2009.
- STUDY POPULATION

➢ Inclusion Criteria :

- Urban School going adolescent boys and girls aged 11-17 years.

➢ Exclusion Criteria :

- Children with major systemic illness and endocrine disorders.
- Students with major dysmorphology or signs of physical deformity.

- **SAMPLE SIZE**

- The prevalence of obesity among adolescents in a previous study was 3.2%. Accusing a precision of 2% with 2 error of 5% the sample size was calculated to be 250 in each age group.
- Using the previous study and in consultation with statistician, the sample size was calculated to be 250 in each age group.
- Total sample size : 1760.

- SAMPLING TECHNIQUE: Stratified randomization

❖ Drop outs: Nil

The study was carried out among the students of urban schools in Coimbatore the participating students belonged to classes 6^{th} to 12^{th} and in the age group 11-18years. The participation in the study was voluntary. The students were surveyed through an age appropriate modified global school based student health survey structured questionnaire on risk factors of non communicable disease. Socioeconomic status was assessed by parent's occupation and income.

- Dietary practices were assessed by putting questions on dietary preference, fast food intake and fruit consumption. Physical activity was ascertained by asking for daily physical activity [running,fast walking.cycling and dancing] for 30 minutes/day during the past 7 days and during a typical week, any involvement in sports at school or in the community and the time spent at home in sitting activities like watching TV and videogames was asked.

  Family history of hypertension and obesity in parents or grandparents was asked. Subsequently anthropometric measurements were taken. Height was measured to the nearest millimeter using a wall mounted measuring scale without footwear. Weight was measured using electronic weighing machine. BP was measured using electronic blood pressure measuring devices.

RESULTS AND ANALYSIS

RESULTS AND ANALYSIS

No of adolescents enrolled:

Total - 1760

Boys - 880

Girls - 880

TABLE - 1

Age and Sex distribution

Count

		Sex		
		Male	Female	Total
Age (Years)	11	125	125	250
	12	125	125	250
	13	125	125	250
	14	130	130	260
	15	125	125	250
	16	125	125	250
	17	125	125	250
Total		880	880	1760

Age and sex distribution were presented in Table1.

In age group of 11-17, 250 –260 students were included in each age group.

Male to female ratio is1:1.

125-130 boys were included in all age groups 11-17.

125-130 girls were included in all age groups 11-17.

Total 1760 students were enrolled in this study.

TABLE -2

Food Habits

		Frequency	Percent
Valid	Non-vegetarian	1497	85.1
	Vegetarian	193	11.0
	Egget	70	4.0
	Total	1760	100.0

Food habits of study group were tabulated in Table No2.

Food habits 85.1%(1497) of students had nonvegetarian eating habits. Only 11% of children were pure vegetarians.

GRAPH- 3

Food Habits

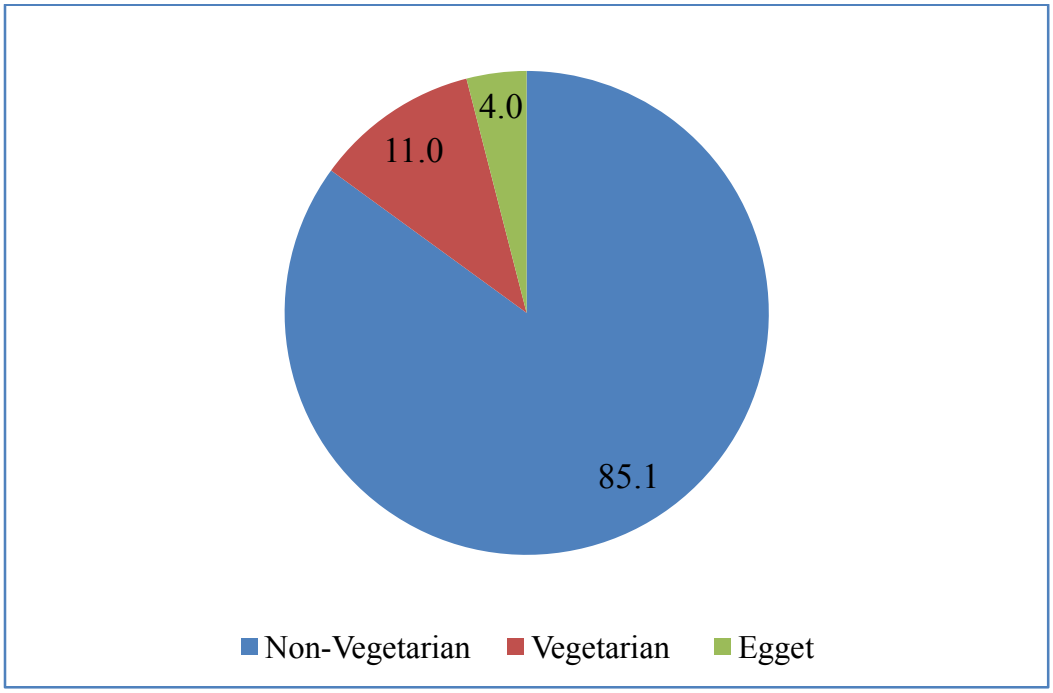


TABLE – 3

Frequency of Fast food intake

		Frequency	Percent
Valid	More Frequent	848	48.2
	Less Frequent	912	51.8
	Total	1760	100.0

Fast food intake frequency is tabulated in table No-3**.**

About a half of them (48.2%) ate fastfood (burgers, pizzas, fried foods, etc)more than three times a week.51.8% had fast food less than three times per week.

Graph -4

Frequency of Fast food intake

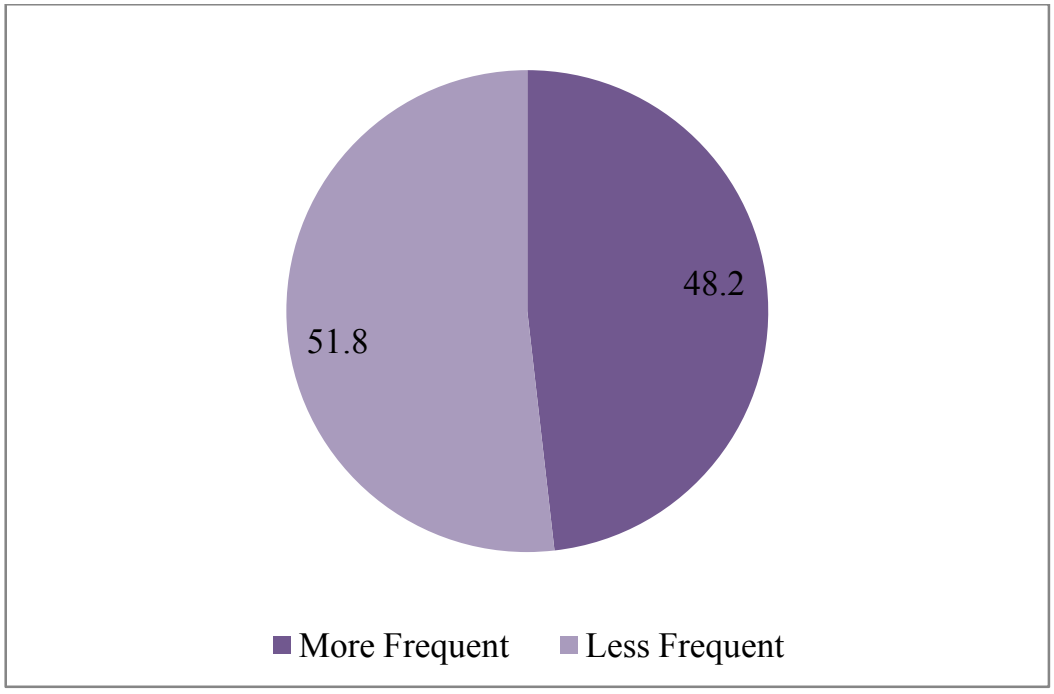


TABLE - 4

Daily consumption of Fruits

		Frequency	Percent
Valid	Yes	1202	68.3
	No	558	31.7
	Total	1760	100.0

Fruits intake of students is tabulated in Table No.4.

Among study group around 68.3% took fruits atleast once daily, remaining 31.7% students took fruits less frequently.

Graph – 5

Daily consumption of Fruits

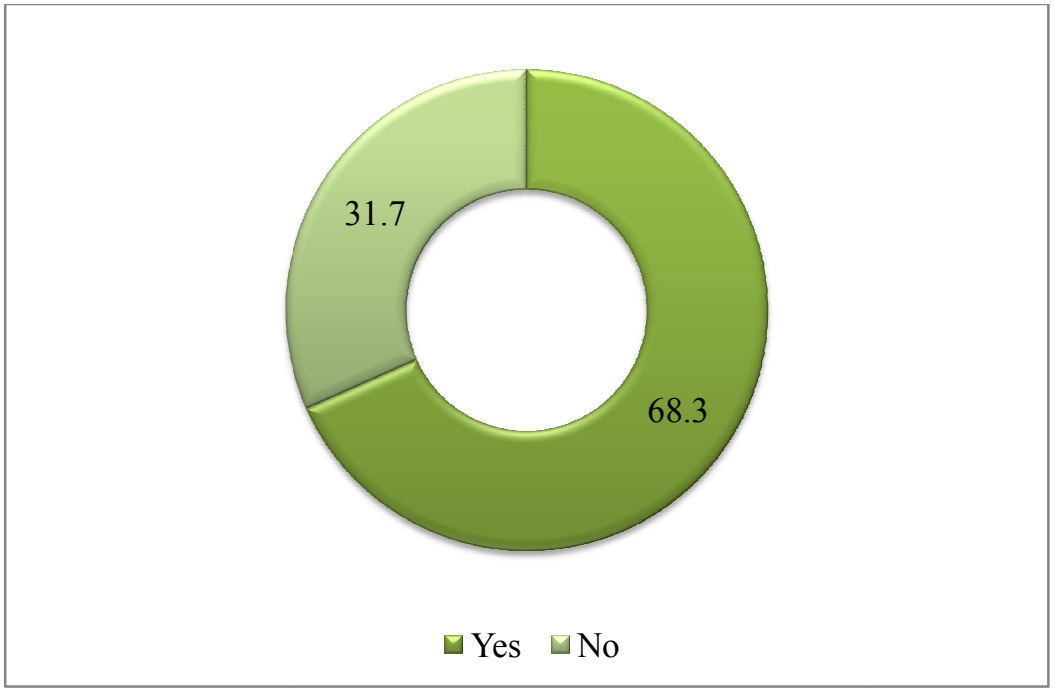


TABLE -5

Daily Physical Activity

		Frequency	Percent
Valid	Yes	580	33.0
	No	1180	67.0
	Total	1760	100.0

Physical activity level is tabulated in Table No.5.Overall there was extremely low physical activity(cycling, dancing, running).

About two thirds (67%) responded as not being physically active for 60minutes per day. Only 33% of students responded as being physically active.

Graph – 6

Daily Physical Activity

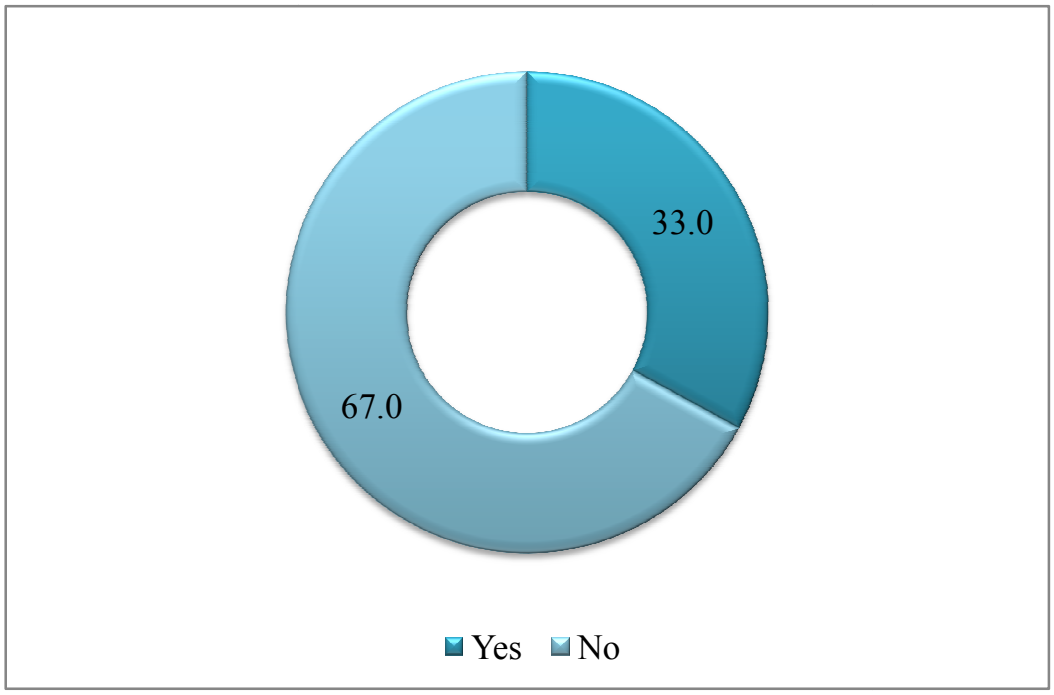


TABLE -6

Sports involvement

		Frequency	Percent
Valid	Yes	759	43.1
	No	1001	56.9
	Total	1760	100.0

Sports activity of study group at school and home is tabulated in Table No.6. 56.9% students replied as not being engaged in sports at school or at home.43.1% of students responded as being engaged in sports.

Graph – 7

Sports involvement

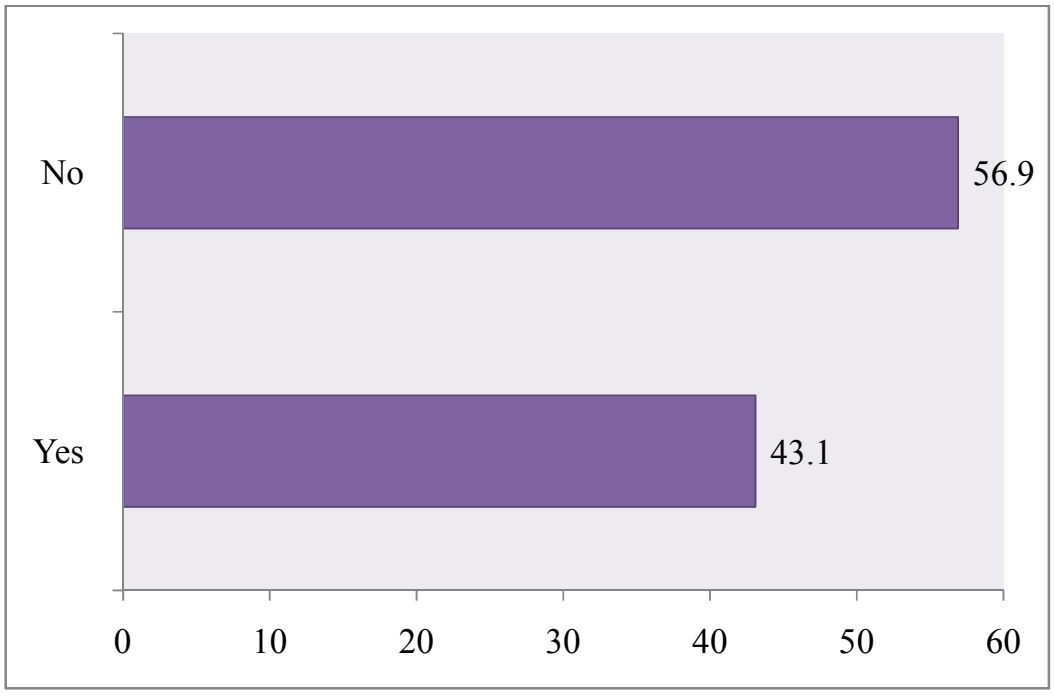


TABLE - 7

Daily Indoor Activity

		Frequency	Percent
Valid	Yes	1283	72.9
	No	477	27.1
	Total	1760	100.0

Frequency of indoor activity of students is represented in Table No.7.

About 72.9% of students spent more than 60minutes per day in sitting activities like watching TV, Computer games, Video games. Only 27.1% students spent less than 60minutes in indoor activity.

Graph- 8

Daily Indoor Activity

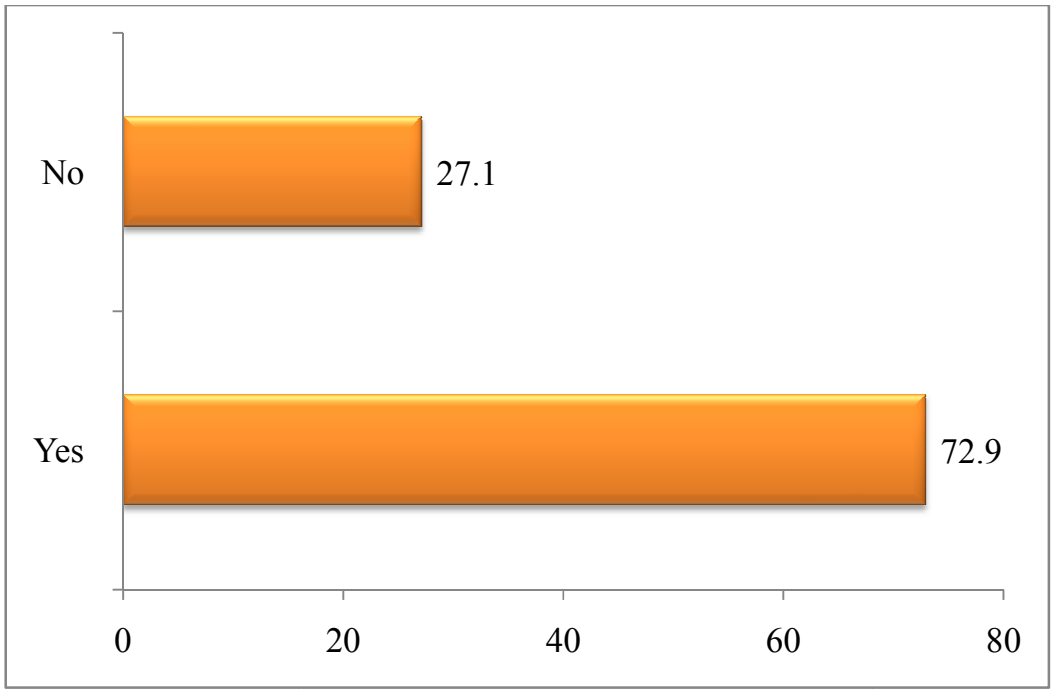


TABLE – 8

Smoking habit

		Frequency	Percent
Valid	Yes	64	3.6
	No	1696	96.4
	Total	1760	100.0

Graph - 9

Smoking habit

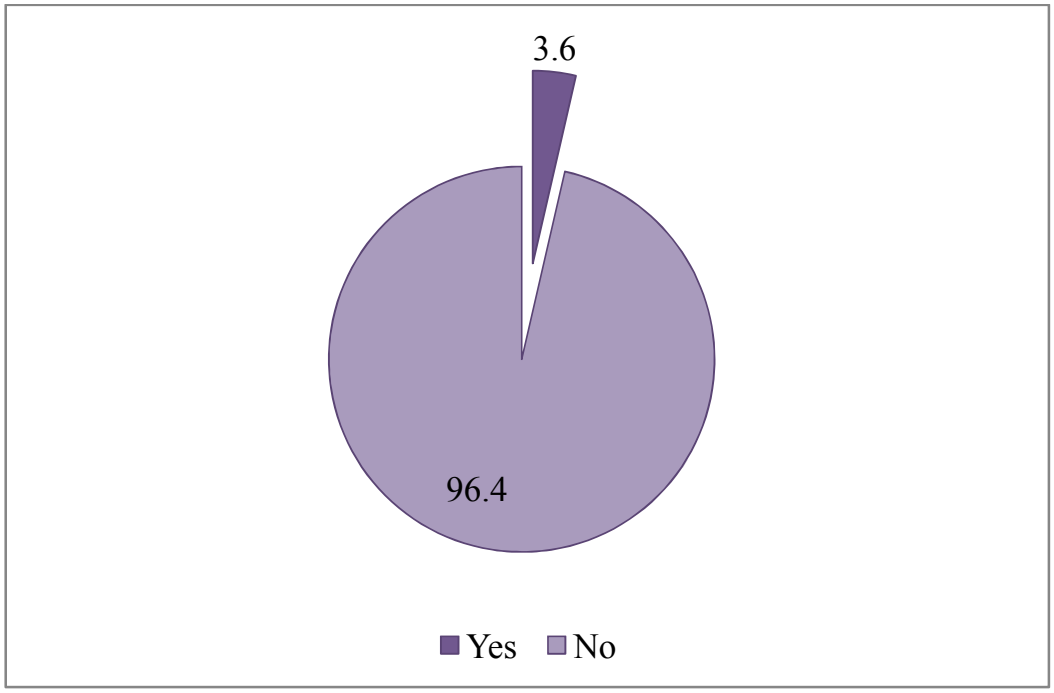


TABLE – 9

Alcohol habit

		Frequency	Percent
Valid	Yes	47	2.7
	No	1713	97.3
	Total	1760	100.0

Graph – 10

Alcohol habit

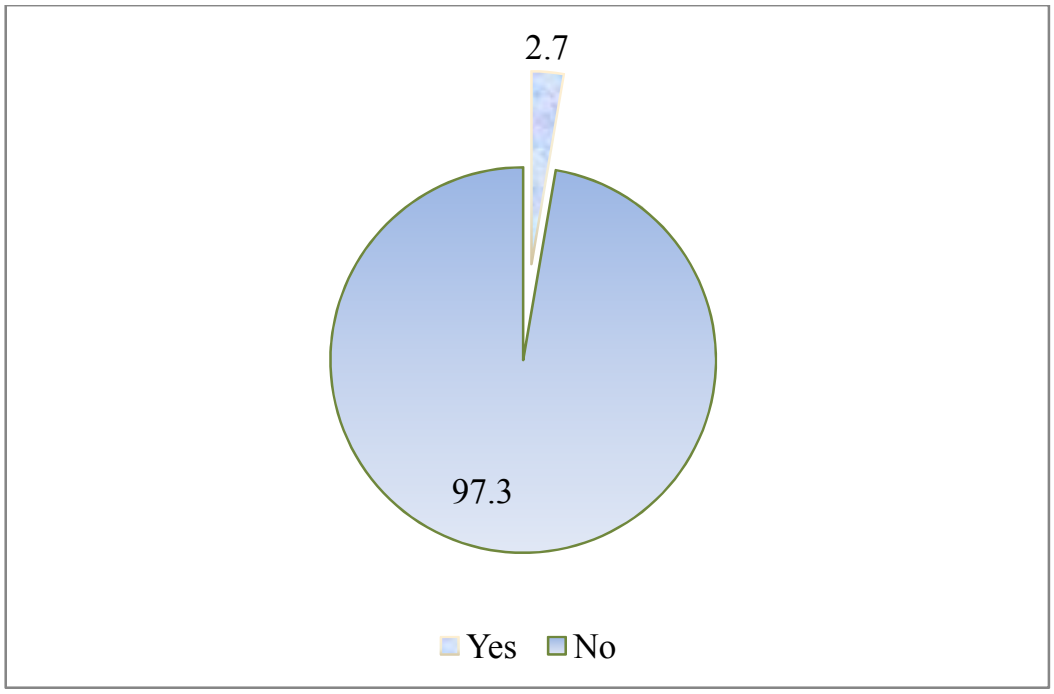


TABLE - 10

Family history of non-communicable diseases

		Frequency	Percent
Valid	DM	166	9.4
	HTN	160	9.1
	Obesity	173	9.8
	DM and Obesity	10	.6
	DM and HTN	75	4.3
	Obese and HTN	33	1.9
	All	37	2.1
	No	1106	62.8
	Total	1760	100.0

Prevalence of noncommunicable diseases in the family of study group is tabulated in Table No.10. 9.8% of students said that they had a family history of obesity(including parents, either one or both).

9.4% of students had a family history of diabetes mellitus. 9.1% of students had a family history of hypertension. 4.3% of students said that they had a family history of both diabetes mellitus and hypertension.

0.6% of students had a family history of both obesity and diabetes mellitus. 1.9% of students had a family history of both obesity and hypertension. 2.1% had a family history of obesity, diabetes mellitus and hypertension. 62.8% responded as no family history of noncommunicable disease in their family.

TABLE - 11

Weight Percentage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 90%	1558	88.5	88.5	88.5
	More than 90%	202	11.5	11.5	100.0
	Total	1760	100.0	100.0	

TABLE - 12

BMI Percentage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 84%	1367	77.7	77.7	77.7
	85 - 94%	303	17.2	17.2	94.9
	Above 94%	90	5.1	5.1	100.0
	Total	1760	100.0	100.0	

Weight percentage & BMI percentage were tabulated in Table No.11&12 respectively.

There is a difference between Weight and Body Mass Index. So we used BMI for calculation & analysis.

BMI above 94% is considered as obesity & BMI between 85-94% is considered as overweight.BMI below 85% is considered as normal weight.

TABLE - 13

BMI Percentiles for age

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Age (Years)	11	Count	159	74	17	250
		% within Age (Years)	63.6%	29.6%	6.8%	100.0%
		% within BMI Percentage	11.6%	24.4%	18.9%	14.2%
	12	Count	148	80	22	250
		% within Age (Years)	59.2%	32.0%	8.8%	100.0%
		% within BMI Percentage	10.8%	26.4%	24.4%	14.2%
	13	Count	177	46	27	250
		% within Age (Years)	70.8%	18.4%	10.8%	100.0%
		% within BMI Percentage	12.9%	15.2%	30.0%	14.2%
	14	Count	207	42	11	260
		% within Age (Years)	79.6%	16.2%	4.2%	100.0%
		% within BMI Percentage	15.1%	13.9%	12.2%	14.8%
	15	Count	220	25	5	250
		% within Age (Years)	88.0%	10.0%	2.0%	100.0%
		% within BMI Percentage	16.1%	8.3%	5.6%	14.2%
	16	Count	231	16	3	250
		% within Age (Years)	92.4%	6.4%	1.2%	100.0%
		% within BMI Percentage	16.9%	5.3%	3.3%	14.2%
	17	Count	225	20	5	250
		% within Age (Years)	90.0%	8.0%	2.0%	100.0%
		% within BMI Percentage	16.5%	6.6%	5.6%	14.2%
Total		Count	1367	303	90	1760
		% within Age (Years)	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

Agewise BMI percentile were tabulated in Table No.13.

In our study 5.1% were obese (BMI >94percentile) and 17.2% were overweight (BMI between 85-94 percentile).

At 11 years of age, 6.8% were obese, 29.6% were overweight.

At 12 years of age, 8.8% were obese, 32% were overweight.

At 13 years of age, 10.8% were obese, 18.4% were overweight.

At 14 years of age, 4.2% were obese and 16.2% were overweight.

At 15 years of age, 2% were obese and 10% were overweight.

At 16 years of age, 1.2% were obese and 6.4% were overweight.

At 17 years of age, 2% were obese and 8% were overweight.

Age wise BMI percentage chart shows obesity is more prevalent in 12 & 13 years of age.

TABLE - 14

BP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Between 90 and 95%	64	3.6	3.6	3.6
	More than 95%	2	.1	.1	3.8
	Less than 90%	1694	96.3	96.3	100.0
	Total	1760	100.0	100.0	

Prevalence of hypertension among study group is tabulated in Table No.14.

Only two students (0.1%) had Blood Pressure >95%

64 students(3.6%) were at risk of hypertension and they are in follow up.

Graph – 11

BP

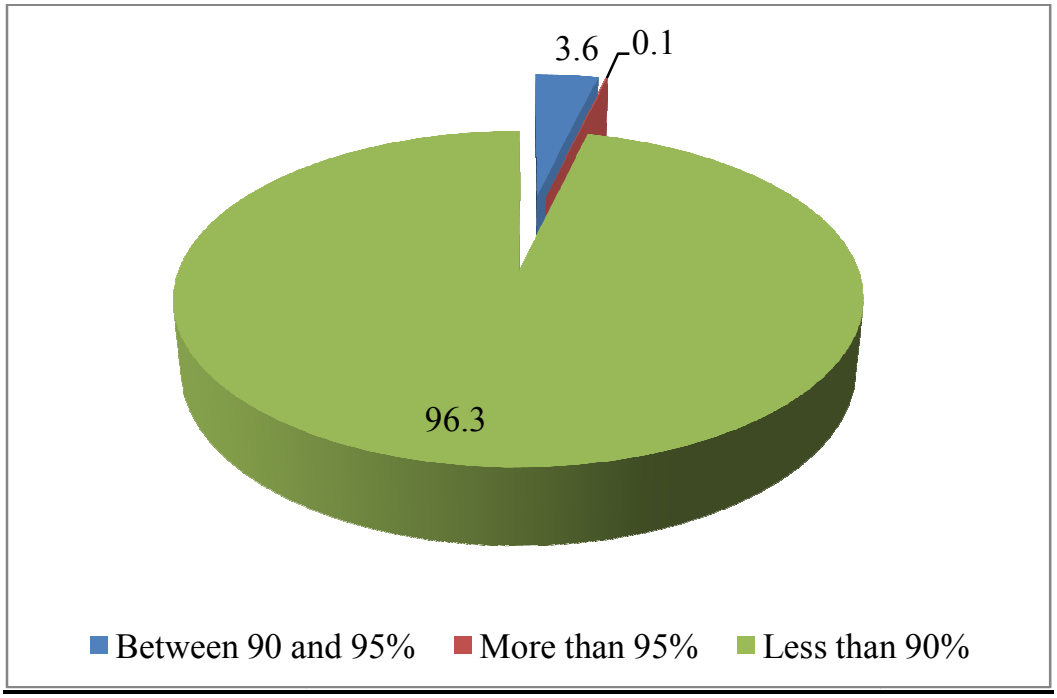


TABLE - 15

Mean weight and Standard deviation

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Weight (Kg)	Male	880	51.2322	10.99281	.37057
	Female	880	49.3555	10.11542	.34099

Mean weight and standard deviation were tabulated in Table No.15. In our study mean weight for boys& girls was 51.2& 49.3kg respectively.

TABLE – 16

Mean Height and Standard deviation

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Height (Cm)	Male	880	159.0601	10.44626	.35214
	Female	880	155.3388	8.57222	.28897

Mean height and standard deviation were tabulated in Table No.16. In our study mean height for boys & girls was 159.0 & 155.3cm respectively.

TABLE – 17

Mean BMI and Standard deviation

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
BMI	Male	880	20.0632	3.28408	.11071
	Female	880	20.3240	3.10874	.10480

Mean BMI and standard deviation were tabulated in 17. Mean BMI and standard deviation for boys was 20.0 & 3.2 respectively. Mean BMI and standard deviation for girls was 20.3 & 3.1 respectively which is very much comparable to NCHS (National Center for Health Statistics) BMI.

TABLE - 18

Relationship between BMI and Food habit

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Food Status	Non-vegetarian	Count	1196	231	70	1497
		% within Food Status	79.9%	15.4%	4.7%	100.0%
		% within BMI Percentage	87.5%	76.2%	77.8%	85.1%
	Vegetarian	Count	124	49	20	193
		% within Food Status	64.2%	25.4%	10.4%	100.0%
		% within BMI Percentage	9.1%	16.2%	22.2%	11.0%
	Egget	Count	47	23	0	70
		% within Food Status	67.1%	32.9%	.0%	100.0%
		% within BMI Percentage	3.4%	7.6%	.0%	4.0%
Total		Count	1367	303	90	1760
		% within Food Status	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE -19

Relationship between BMI and Fast Food

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Fast Food	More Frequent	Count	562	218	68	848
		% within Fast Food	66.3%	25.7%	8.0%	100.0%
		% within BMI Percentage	41.1%	71.9%	75.6%	48.2%
	Less Frequent	Count	805	85	22	912
		% within Fast Food	88.3%	9.3%	2.4%	100.0%
		% within BMI Percentage	58.9%	28.1%	24.4%	51.8%
Total		Count	1367	303	90	1760
		% within Fast Food	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE – 20

Relationship between BMI and Fruit

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Fruits	Yes	Count	937	209	56	1202
		% within Fruits	78.0%	17.4%	4.7%	100.0%
		% within BMI Percentage	68.5%	69.0%	62.2%	68.3%
	No	Count	430	94	34	558
		% within Fruits	77.1%	16.8%	6.1%	100.0%
		% within BMI Percentage	31.5%	31.0%	37.8%	31.7%
Total		Count	1367	303	90	1760
		% within Fruits	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE – 21

Relationship between BMI and Physical Activity

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Physical	Yes	Count	532	39	9	580
		% within Physical	91.7%	6.7%	1.6%	100.0%
		% within BMI Percentage	38.9%	12.9%	10.0%	33.0%
	No	Count	835	264	81	1180
		% within Physical	70.8%	22.4%	6.9%	100.0%
		% within BMI Percentage	61.1%	87.1%	90.0%	67.0%
Total		Count	1367	303	90	1760
		% within Physical	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE – 22

Relationship between BMI and Sports involvement

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Sports	Yes	Count	678	65	16	759
		% within Sports	89.3%	8.6%	2.1%	100.0%
		% within BMI Percentage	49.6%	21.5%	17.8%	43.1%
	No	Count	689	238	74	1001
		% within Sports	68.8%	23.8%	7.4%	100.0%
		% within BMI Percentage	50.4%	78.5%	82.2%	56.9%
Total		Count	1367	303	90	1760
		% within Sports	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE - 23

Relationship between BMI and Indoor Activity

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Indoor	Yes	Count	924	276	83	1283
		% within Indoor	72.0%	21.5%	6.5%	100.0%
		% within BMI Percentage	67.6%	91.1%	92.2%	72.9%
	No	Count	443	27	7	477
		% within Indoor	92.9%	5.7%	1.5%	100.0%
		% within BMI Percentage	32.4%	8.9%	7.8%	27.1%
Total		Count	1367	303	90	1760
		% within Indoor	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE – 24

Relationship between BMI and Smoking

Crosstab

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Smoking	Yes	Count	58	3	3	64
		% within Smoking	90.6%	4.7%	4.7%	100.0%
		% within BMI Percentage	4.2%	1.0%	3.3%	3.6%
	No	Count	1309	300	87	1696
		% within Smoking	77.2%	17.7%	5.1%	100.0%
		% within BMI Percentage	95.8%	99.0%	96.7%	96.4%
Total		Count	1367	303	90	1760
		% within Smoking	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE - 25

Relationship between BMI and Alcohol

Crosstab

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Alcohol	Yes	Count	41	5	1	47
		% within Alcohol	87.2%	10.6%	2.1%	100.0%
		% within BMI Percentage	3.0%	1.7%	1.1%	2.7%
	No	Count	1326	298	89	1713
		% within Alcohol	77.4%	17.4%	5.2%	100.0%
		% within BMI Percentage	97.0%	98.3%	98.9%	97.3%
Total		Count	1367	303	90	1760
		% within Alcohol	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

TABLE - 26

Relationship between BMI and Family history

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
Family History	DM	Count	133	26	7	166
		% within Family History	80.1%	15.7%	4.2%	100.0%
		% within BMI Percentage	9.7%	8.6%	7.8%	9.4%
	HTN	Count	116	40	4	160
		% within Family History	72.5%	25.0%	2.5%	100.0%
		% within BMI Percentage	8.5%	13.2%	4.4%	9.1%
	Obesity	Count	114	39	20	173
		% within Family History	65.9%	22.5%	11.6%	100.0%
		% within BMI Percentage	8.3%	12.9%	22.2%	9.8%
	DM and Obesity	Count	9	1	0	10
		% within Family History	90.0%	10.0%	.0%	100.0%
		% within BMI Percentage	.7%	.3%	.0%	.6%
	DM and HTN	Count	53	20	2	75
		% within Family History	70.7%	26.7%	2.7%	100.0%
		% within BMI Percentage	3.9%	6.6%	2.2%	4.3%
	Obese and HTN	Count	21	2	10	33
		% within Family History	63.6%	6.1%	30.3%	100.0%
		% within BMI Percentage	1.5%	.7%	11.1%	1.9%
	All	Count	34	1	2	37
		% within Family History	91.9%	2.7%	5.4%	100.0%
		% within BMI Percentage	2.5%	.3%	2.2%	2.1%
	No	Count	887	174	45	1106
		% within Family History	80.2%	15.7%	4.1%	100.0%
		% within BMI Percentage	64.9%	57.4%	50.0%	62.8%
Total		Count	1367	303	90	1760
		% within Family History	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

The risk factors and its association with overweight and obesity are tabulated in Tab No 19-26.

According to our study obesity was more common among vegetarians than nonvegetarians(10.4% versus 4.7%).

There was a positive correlation between fastfood intake and obesity. Obesity is more common among students who ate fastfood frequently(8% as against 2.6%).

Other risk factors which were found to be correlated were indoor activity,family history.

Among students who had increased indoor activity 21.5% were overweight and 6.5% were obese. Among students who had decreased indoor activity 5.7% were overweight and1.5% were obese.

Among students who had a family history of obesity 22.5% were overweight & 11.6% were obese.

There was a negative correlation between physical activity, sports involvement and obesity.

Among study population who had less frequent physical activity 22.4% were overweight and 6.9% were obese.

Among study population who had no sports involvement 23.8% were overweight and 7.4% were obese.

The other risk factors which were found to be non-contributary were fruit intake, being non-vegetarian, smoking, alcohol consumption.

TABLE - 27

Relationship between BMI and BP

Crosstab

			BMI Percentage			
			Less than 84%	85 - 94%	Above 94%	Total
BP	Between 90 and 95%	Count	19	24	21	64
		% within BP	29.7%	37.5%	32.8%	100.0%
		% within BMI Percentage	1.4%	7.9%	23.3%	3.6%
	More than 95%	Count	0	0	2	2
		% within BP	.0%	.0%	100.0%	100.0%
		% within BMI Percentage	.0%	.0%	2.2%	.1%
	Less than 90%	Count	1348	279	67	1694
		% within BP	79.6%	16.5%	4.0%	100.0%
		% within BMI Percentage	98.6%	92.1%	74.4%	96.3%
Total		Count	1367	303	90	1760
		% within BP	77.7%	17.2%	5.1%	100.0%
		% within BMI Percentage	100.0%	100.0%	100.0%	100.0%

Blood pressure and BMI relationship is tabulated in Table No 27. Hypertension is more common in obese children. 2 students with hypertension have BMI above 95th percentile.

TABLE – 28

Correlation between BMI and risk factors

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.404	.215		15.798	.000
	Age (Years)	-.074	.006	-.270	-12.981	.000
	Sex	-.145	.023	-.132	-6.236	.000
	Food Status	.083	.023	.073	3.642	.000
	Fast Food	-.221	.023	-.201	-9.734	.000
	Fruits	.002	.024	.001	.073	.941
	Physical	.135	.026	.116	5.286	.000
	Sports	.181	.025	.163	7.322	.000
	Indoor	-.196	.026	-.159	-7.678	.000
	Smoking	.048	.067	.016	.715	.474
	Alcohol	.022	.078	.007	.286	.775
	Family History	-.005	.004	-.024	-1.166	.244
	BP	-.344	.030	-.235	-11.588	.000

a. Dependent Variable: BMI Percentage

Table - 29

T-Test

Correlations

Correlations

		BMI	Sports	Indoor	Smoking	Alcohol	Family History
BMI	Pearson Correlation	1	-.593	.507	.099	.094	-.001
	N	1760	1760	1760	1760	1760	1760
Sports	Pearson Correlation	-.593	1	-.070	.094	.155	.042
	N	1760	1760	1760	1760	1760	1760
Indoor	Pearson Correlation	.507	-.070	1	.023	.045	.015
	N	1760	1760	1760	1760	1760	1760
Smoking	Pearson Correlation	.099	.094	.023	1	.457	.029
	N	1760	1760	1760	1760	1760	
Alcohol	Pearson Correlation	.094	.155	.045	.457	1	.002
	N	1760	1760	1760	1760	1760	1760
Family History	Pearson Correlation	-.001	.042	.015	.029	.002	1
	N	1760	1760	1760	1760	1760	1760

Table -30

Correlations

		Sex	Food Status	Fast Food	Fruits	Physical	BMI
Sex	Pearson Correlation	1	-.041	.080	-.046	.012	.041
	N	1760	1760	1760	1760	1760	1760
Food Status	Pearson Correlation	-.041	1	.051	.021	.022	.064
	N	1760	1760	1760	1760	1760	1760
Fast Food	Pearson Correlation	.080	.051	1	-.022	-.083	.729
	N	1760	1760	1760	1760	1760	1760
Fruits	Pearson Correlation	-.046	.021	-.022	1	.054	.040
	N	1760	1760	1760	1760	1760	1760
Physical	Pearson Correlation	.012	.022	-.083	.054	1	-.666
	N	1760	1760	1760	1760	1760	1760
BMI	Pearson Correlation	.041	.064	.729	.040	-.666	1
	N	1760	1760	1760	1760	1760	1760

Correlation between BMI and risk factors is tabulated in Table No-28-30. Significant correlation between BMI and Fast Food intake Physical Activity, Sports involvement, Indoor activity.

There is no significant correlation between BMI and Fruits intake, Smoking, Alcohol habit, Family history.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.550[a]	.303	.298	.46007

a. Predictors: (Constant), BP, Smoking, Food Status, Family History, Fruits, Indoor, Sports, Fast Food, Age (Years), Sex, Physical, Alcohol

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	160.667	12	13.389	63.255	.000[a]
	Residual	369.782	1747	.212		
	Total	530.449	1759			

a. Predictors: (Constant), BP, Smoking, Food Status, Family History, Fruits, Indoor, Sports, Fast Food, Age (Years), Sex, Physical, Alcohol

b. Dependent Variable: BMI Percentage

DISCUSSION

DISCUSSION

The present study was a cross sectional one focusing on risk factors contributing to the development of non-communicable diseases particularly obesity, among students from urban schools in Coimbatore. This study definitely provides a pointer to the direction of rising noncommunicable diseases and their risk factors in urban population.

The present study indicates that overweight &obesity were more common among vegetarians, which can be explained on the basis of the fact that most of the fast foods &junk foods are high calorie foods of nonanimal origin.

Regarding consumption of fastfood it appeared that children with higher BMI were consuming more fastfood. ($p<0.001$). Fruits were being consumed on a regular basis by only 68.3% of the children. It did not seem to contribute in anyway as a risk factor.

Physical activity is decreasing among school children.Physical activity for more than 60 minutes daily & active involvement in sports have shown to affect BMI. BMI is lesser among physically active children.

Prevalence of Indoor activity is increasing in school children.They spent >60minutes/day in indoor activities like watching TV, Computer games, Video games. Indoor activity seems to contribute as a risk factor for obesity. Family history of obesity has a positive correlation with BMI.

The present study indicates that 3.6% students have smoked atleast once in their life. Smoking however did not appear to contribute to an increase in BMI. It was found that alcohol was consumed atleast once by 2.7% of students. All were boys aged 14&more.Alcohol did not seem to contribute as a risk factor to developing obesity in our study.

In our study 5.1% were obese and 17.2% were overweight. Among the study group 3.6% of students found to have high normal Blood Pressure & 0.1% have hypertension. Both referred to hypertension clinic Coimbatore Medical College Hospital for further evaluation like lipid profile, sugar, ECG, renal parameters. Their results came as normal. They are in regular follow up.

Khadikar et al had estimated that the prevalence of obesity according to the IOTF cut off points was 5.7% whereas, the prevalence of overweight was 19.9% in 1228 urban affluent school boys in Pune[14]. Other studies have demonstrated similar trends of increasing BMI. Gupta

et al studied atherosclerosis risk factors-tobacco use, obesity, hypertension, total cholesterol level and dietary intake of atherogenic nutrients in 237 adolescent school children aged 13-17 in Rajasthan. This study showed a higher prevalence of metabolic and dietary coronary risk factors among adolescent of the middle and upper middle class in India.[15]

It has been shown in various studies that the prevalence of risk factors for non-communicable diseases in childhood and adolescence bears significant tendency towards development of disease in aduldhood.[16,17,18] Several studies have shown that primary prevention of these disorders by risk factor education in the community has better benefits compared to secondary prevention for cardio vascular mortality as well as morbidity[19,20,21].

SUMMARY

SUMMARY

In this study titled “life style associated risk factors for non communicable diseases in adolescents”, 1760 urban school students of Coimbatore in the age group of 11 to 17 years are evaluated for the prevalence of life style associated risk factors for non communicable diseases .

There was a significant correlation between body mass index and fast food intake , physical activity.

Based on results of this study, it can be concluded that by modifying certain factors , such as fast food intake and physical activity , we can bring about a significant reduction in the prevalence of adolescent obesity in our society.

CONCLUSIONS

CONCLUSION

Risk factors contributing to the development of non-communicable diseases particularly obesity in adolescents are frequent fast food intake, low physical activity, poor sports involvement, high indoor activity. primary prevention of these disorders by risk factor education in the community has better benefits compared to secondary prevention. Intervention is therefore, a necessary step at school level itself for the prevention of non-communicable diseases. This is an eye opener for doing further studies in adolescent students.

ANNEXURE

PROFORMA

NAME:

AGE: SEX:

SCHOOL: CLASS:

SOCIOECONOMIC STATUS (OCCUPATION):

Father:

Mother:

Total monthly income:

FOOD STATUS:

Vegetarian/ Nonvegetarian/ Eggetarian

1. Fastfood consumption in a week:

(Pizza, Burger, Sandwich, Panipuri, Belpuri)

No of times:

Type of food:

2. Consumption of fruit in daily diet: (Yes/No)

PHYSICAL ACTIVITY

Daily physical activity and duration:

1)Running 2)Cycling 3)Dancing 4)Fast walking 5)Others

Any involvement in sports at the school:

(if yes specify) Street:

Time spent at home (indoor activities) :

like Watching TV, Video Games, Computer, Others.

PERSONAL HABITS

Smoking (yes/no)

If yes the no of cigarettes in the last 30 days:

Alcohol intake (yes/no)

If yes no of times in the last 6 months:

HEALTH STATUS OF PARENTS:

Diabetes mellitus:y/n

Hypertension:y/n

Obesity:y/n

Others:

EXAMINATION

Weight: Height:

BMI: BP:

ABBREVIATIONS

BMI	:	Body Mass Index
BP	:	Blood Pressure
DM	:	Diabetes Mellitus
HTN	:	Hypertension
HT	:	Height
WT	:	Weight
SES	:	Socio Economic Status

BIBILIOGRAPHY

BIBILIOGRAPHY

1. **Nelson textbook of pediatrics**, 18th edition, Chapter 44 Page 232-237.

2. **Goyal RK, Shah VN, Saboo BD, Phatak SR, Shah NN, Gohel MC, Raval PB, Patel SS.** Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated lifestyle factors. ***J Assoc Physicians India. 2010 Mar;58:151-8.***

3. **Goyal RK, Shah VN, Saboo BD, Phatak SR, Shah NN, Gohel MC, Raval PB, Patel SS.**Secular trends in obesity, regional adiposity and metabolic parameters among Asian Indian adolescents in north India: a comparative data analysis of two selective samples 5 years apart (2003, 2008). ***Ann Nutr Metab. 2010;56(3):176-81. Epub 2010 Feb 25.***

4. **Singhal N, Misra A, Shah P, Gulati S. Eur J Clin Nutr,** Effects of controlled school-based multi-component model of nutrition and lifestyle interventions on behavior modification, anthropometry and metabolic risk profile of urban Asian Indian adolescents in North India. ***2010 Apr;64(4):364-73. Epub 2010 Jan 20.***

5 . **Vikram NK, Pandey RM, Misra A, Goel K, Gupta N. Asia Pac J Clin Nutr,** Factor analysis of the metabolic syndrome components in urban Asian Indian adolescents. ***2009;18(2):293-300***

6 . **Gupta R, Misra A, Vikram NK, Kondal D, Gupta SS, Agrawal A, Pandey RM,** Younger age of escalation of cardiovascular risk factors in Asian Indian subjects. ***BMC Cardiovasc Disord. 2009 Jul 5;9:28.***

7. **Chathurvedi D, Khadgawat R, Kulshrestha B, Gupta N, Joseph AA, Diwedi S, Ammini AC,** Type 2 diabetes increases risk for obesity among subsequent generations. ***Diabetes Technol Ther. 2009 Jun;11(6):393-8.***

8. **Singh AK, Maheshwari A, Sharma N, Anand K,** Lifestyle associated risk factors in adolescents. ***Indian J Pediatr. 2006 Oct;73(10):901-6.***

9. **Anand K, Shah B, Yadav K, Singh R, Mathur P, Paul E, Kapoor SK**, are the urban poor vulnerable to non-communicable diseases? A survey of risk factors for non-communicable diseases in urban slums of Faridabad. ***Natl Med J India. 2007 May-Jun;20(3):115-20.***

10. **Sugathan TN, Soman CR, Sankaranarayanan K,** Behavioural risk factors or non communicable diseases among adults in Kerala, India. ***Natl Med J India. 2007 May-Jun;20(3):115-20.***

11. **Nath A, Garg S, Deb S, Ray A, Kaur R**, Profile of behavioural risk factors of non-communicable diseases in an urban setting in New Delhi. ***Indian J Public Health. 2009 Jan-Mar;53(1):28-30.***

12. **Misra A, Khurana L,** The metabolic syndrome in South Asians: epidemiology, determinants, and prevention. ***Metab Syndr Relat Disord. 2009 Dec;7(6):497-514.***

13. **De Onis M, Blossner M,** Prevalence and trends of overweight among pre-school children in Developing countries. ***American Journal of Clinical Nutrition 2000; 72 : 1032-1039.***

14. **Khadilkar VV, Khadilkar AV**, Prevalence of Obesity in affluent school boys in Pune. ***Indian Pediatrics 2004; 41 : 857-858.***

15. **Gupta R, Goyale A, Kashyap S et al,** Prevalence of atherosclerosis risk factors in adolescent school children. ***Indian Pediatrics 1997; 34 : 923-927.***

16. **McCarron P, Davey Smith G, Okasha M, McEwen J,** Blood pressure in young adulthood and mortality from cardiovascular disease, ***Lancet 2000; 355: 1430-1431.***

17. **Kurpad AV, Swaminathan S, Bhat,** IAP National Task Force for Childhood Prevention of Adulthood Diseases; the effect of childhood physical activity on prevention of adult diseases, ***Indian Pediatrics 2004; (41) : 37-62.***

18. **Whitaker RC, Wright JA, Pepe MS et al,** Predicting obesity in young adulthood from childhood and parental obesity, ***NEJM 1997; 337: 869-873.***

19. **Beaglehole R,** Medical management and the decline in mortality from coronary heart disease, ***BMJ 1986; 292: 33-35.***

20. **Capewell S, Morrison CE, McMurray JJ,** Contribution of modern cardio vascular treatment and risk factor changes to the decline in coronary heart disease mortality in Scotland between 1975-1994, ***Heart ,1999; 81: 380-386.***

21. **Una B, Critchley JA, Capewell S,** Explaining the decline in CHD in England and Wales between 1981-2000, ***Circulation 2004; 109: 1101-1107.***

22. **Elizabeth textbook of nutrition and Child Development**, Chapter 13,Page 349-357.